What is claimed is:

1.   A method for determining the density of a fluid in a downhole environment comprising:

placing a fluid in contact with a first wall;

transmitting an acoustic pulse at a first frequency through the first wall and thence into the fluid;

determining a reflection coefficient for the first-wall/fluid interface from the exponential decline in the integrated pulse echo energies;

determining the sound speed in the fluid; and

determining the density of the fluid.

2.   The method of claim 1, further comprising:

detecting a plurality of echo returns from an interface between the first wall and the fluid; and

integrating energy from each echo return pulse inside of the wall.

3.   The method of claim 1, further comprising:

determining a slope of pulse energy decay for echo return pulses inside of the first wall.

4.   The method of claim 1, further comprising:

detecting an echo return pulse from the second wall to determine the speed of sound in the fluid.

5.   The method of claim 1, further comprising:

determining a reflection coefficient for an interface between an acoustic pulse transmitter and the exterior of the first wall.

6.   The method of claim 1, further comprising:

determining a reflection coefficient for an interface between the interior of the first wall and the fluid.

7.   The method of claim 1, further comprising:

determining an absorption coefficient for the fluid.

8.   The method of claim 7, further comprising:

pulsing at a second frequency.

9.   The method of claim 1, further comprising:

detecting a plurality of echo returns from an interface between the first wall and the fluid;

integrating energy from each echo return pulse inside of the wall;

determining a slope of pulse energy decay for echo return pulses inside of the first wall;

detecting an echo return pulse from the second wall to determine the speed of sound in the fluid;

determining a reflection coefficient for an interface between an acoustic pulse transmitter and the exterior of the first wall; and

determining a reflection coefficient for an interface between the interior of the first wall and the fluid.

10.   The method of claim 9, further comprising:

pulsing at a second frequency;

determining an absorption coefficient for the fluid; and

determining a viscosity for the fluid.

11. A computer readable medium containing instructions that when executed by a computer implement a method for determining the density of a fluid comprising in a downhole environment comprising:

placing a fluid in a container having a first and second wall;

transmitting an acoustic pulse at a first frequency through the first wall and into the fluid;

determining a reflection coefficient for the inner wall/fluid interface;

calculating the sound speed in the fluid; and

determining the density of the fluid.

12. The medium of claim 11, further comprising:

detecting a plurality of echo returns from an interface between the first wall and the fluid; and

integrating energy from each echo return pulse inside of the wall.

13. The medium of claim 11, further comprising:

determining a slope of pulse energy decay for echo return pulses inside of the first wall.

14. The medium of claim 11, further comprising:

detecting an echo return pulse from the second wall to determine the speed of sound in the fluid.

15. The medium of claim 11, further comprising:

determining a reflection coefficient for an interface between an acoustic pulse transmitter and the exterior of the first wall.

16. The medium of claim 11, further comprising:

determining a reflection coefficient for an interface between the interior of the first wall and the fluid.

17. The method of claim 11, further comprising:

determining an absorption coefficient for the fluid.

18. The method of claim 17, further comprising:

pulsing at a second frequency.

19. The method of claim 11, further comprising:

detecting a plurality of echo returns from an interface between the first wall and the fluid;

integrating energy from each echo return pulse inside of the wall;

determining a slope of pulse energy decay for echo return pulses inside of the first wall;

detecting an echo return pulse from the second wall to determine the speed of sound in the fluid;

determining a reflection coefficient for an interface between an acoustic pulse transmitter and the exterior of the first wall; and

determining a reflection coefficient for an interface between the interior of the first wall and the fluid.

20. The method of claim 19, further comprising:

pulsing at a second frequency;

determining an absorption coefficient for the fluid; and

determining a viscosity for the fluid.

21. An apparatus for determining the density of a fluid comprising in a downhole environment comprising:

a container having a first and second wall for containing a fluid;

acoustic pulser for transmitting an acoustic pulse at a first frequency through the first wall and into the fluid;

a function for determining a reflection coefficient for the inner wall/fluid interface,

a function for calculating the sound speed in the fluid; and

a function for determining the density of the fluid.

22. The apparatus for claim 21, further comprising:

a transducer for detecting a plurality of echo returns from an interface between the first wall and the fluid; and

a integrator for integrating energy from each echo return pulse inside of the wall.

23. The apparatus of claim 21, further comprising:

a function for determining a slope of pulse energy decay for echo return pulses inside of the first wall.

24. The apparatus of claim 21, further comprising:

a function for detecting an echo return pulse from the second wall to determine the speed of sound in the fluid.

25. The apparatus of claim 1, further comprising:

determining a reflection coefficient for an interface between an acoustic pulse transmitter and the exterior of the first wall.

26. The apparatus of claim 21, further comprising:

a function for determining a reflection coefficient for an interface between the interior of the first wall and the fluid.

27. The apparatus of claim 21, further comprising:

a function for determining an absorption coefficient for the fluid.

28. The method of claim 27, further comprising:

an acoustic pulsing device for pulsing at a second frequency.

29. The apparatus of claim 21, further comprising:

a function for detecting a plurality of echo returns from an interface between the first wall and the fluid;

an integrator integrating energy from each echo return pulse inside of the wall;

a function for determining a slope of pulse energy decay for echo return pulses inside of the first wall;

a function for detecting an echo return pulse from the second wall to determine the speed of sound in the fluid;

a function for determining a reflection coefficient for an interface between an acoustic pulse transmitter and the exterior of the first wall; and

a function for determining a reflection coefficient for an interface between the interior of the first wall and the fluid.

30. The apparatus of claim 29, further comprising:

an acoustic pulsing device for pulsing at a second frequency;

a function for determining an absorption coefficient for the fluid; and

a function for determining a viscosity for the fluid.

31. A system for determining the density of a downhole fluid comprising:

a surface controller for lowering a tool into a borehole;

a container located in the tool, the container having a first and second wall for containing a fluid;

an acoustic pulser for transmitting an acoustic pulse at a first frequency through the first wall and into the fluid;

a function for determining a reflection coefficient for the inner wall/fluid interface,

a function for calculating the sound speed in the fluid; and

a function for determining the density of the fluid.